CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

J1803

Project Title

Visualizing the Invisible: At Home with a Schlieren Camera

Abstract

Objectives/Goals

Energy is being produced from many household objects in the form of heat. This heat is invisible to the human eye and goes unnoticed. Visualizing heat would help us appreciate energy loss and maybe help us be more energy efficient. Schlieren photography is one way to visualize heat convention but the equipment is expensive and only available in science labs. Our objective was build an inexpensive version of the Schlieren camera for everyday use.

Methods/Materials

Using an inexpensive 16 centimeter diameter concave mirror and a pinpoint light source (modified LED thats 17 candela bright) was focused onto the edge of a razor blade. A camera fitted with a high zoom was focused onto the mirror and arranged to image the distorted light beam. After the LED is in focus and lined up with the camera and blade, the image was displayed. Various test objects that produce heat convention, including candle, computer fan and hairdryer, were used to distort the light and record an image.

Results

Using the methods described above we found that a very bright LED and a pinpoint was required in order to produce enough light for anything to work. Focusing the light to the edge of the razor blade was critical to have the experiment work at its best. With this arrangement the camera was very sensitive to any light distortion by heat, leaving a amazing image. To demonstrate the sensitivity of this device we imaged the heat wave coming from the human mouth when someone was breathing and even a burp!

Conclusions/Discussion

We were able to build a Schlieren camera from modified but readily available resources found around our house. Using this setup, and given enough patience and time, we were able to demonstrate heat convection from many objects. We were amazed at how sensitive and precise the camera was and how much energy we waste every day. In conclusion we succeeded in making a low cost Schlieren camera and being able to see light being distorted by heat.

Summary Statement

Visualizing the convection of heat with a reengineered Schlieren camera.

Help Received

Parents helped glueing poster, soldiering wires and buying supplies